Programme for International Student Assessment

PISA Australia in Focus Number 4

Anxiety

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SECTION A

Schoolwork-related anxiety in PISA 2015

At the beginning of each new school year advice is handed out to parents about how to deal with worries and anxieties around school, whether it be their child's first year or last. School can bring a whirl of worries and questions – Who will I sit with at lunch? Where do I go when the bell rings? What if I don't know the answer to a question?

Among younger students there is separation anxiety – concern around being separated from a parent or caregiver. As they progress through school, students can face social anxiety – concern about social relationships and interactions with other people, performance and test anxiety – concern around performance and assessment situations, and school refusal – in which students refuse to attend school as it has all become too strongly associated with anxiety (Merrell, 2008). Educators and parents alike are becoming increasingly aware of the emotional aspects of education and the importance of addressing concerns and anxieties that relate to school and learning.

The pressure to get good grades is one of the most frequently cited sources of stress for school-age children and adolescents (OECD, 2017). Both schoolwork-related anxiety and test anxiety have been shown to have a negative impact on student academic performance and general well-being (Chapell et al, 2005). As students move into the later years of schooling, the academic demand on them increases and they are expected to manage this along with their emotional responses to it. It is important that educators, parents and students are aware of the signs of schoolwork-related anxiety and know where to access support.

Alongside the assessments of students' performance in reading, mathematics and scientific literacy, PISA also collects information about their experiences of schooling – their worries, their interests and goals. In some cycles, the focus of these questions relates to the major domain of assessment, while in others, the focus is more general. For example, in 2003 and 2012, the major domain of assessment was mathematics, and items in the student questionnaire collected information about students' attitudes towards mathematics, including how anxious they felt about mathematics. In 2015, when the major domain of assessment was science, the anxiety items were about schoolwork in general.

This report begins with an examination of general schoolwork-related anxiety (as measured in 2015), before moving on to discussing mathematics anxiety (as measured in 2003 and 2012) and monitoring changes in Australian students' anxiety about mathematics between the two PISA cycles.

How schoolwork-related anxiety is measured in PISA

In 2015, PISA collected information on the students' reports about their schoolwork-related anxiety. Students were asked to rate their level of agreement (strongly agree; agree; disagree; or strongly disagree) to the following statements:

- *I often worry that it will be difficult for me to take a test*
- *I worry I will get poor grades at school*
- *I feel very anxious even if I am well-prepared for a test*
- *I get very tense when I study for a test*
- *I get nervous when I do not know how to solve a task at school*

Responses of 'agree' or 'strongly agree' were combined and are referred to as agreement. Responses to these five statements were also combined to construct the schoolwork-related anxiety index, with higher scores reflecting higher levels of schoolwork-related anxiety and lower scores reflecting lower levels of anxiety.

Schoolwork-related anxiety across countries

Eleven countries, including both high-performing and culturally similar English-speaking countries, were selected for comparison with Australia.

High-performing countries: Canada, Estonia, Finland, Hong Kong (China), Japan, Macao (China), and Singapore. These countries performed significantly higher in scientific, reading and mathematical literacy than Australia in PISA 2015.

Culturally similar English-speaking OECD countries: New Zealand, the United Kingdom, Ireland and the United States.

Country	All students	
	Mean index	SE
Singapore	0.57	0.01
Macao (China)	0.37	0.01
Hong Kong (China)	0.33	0.01
New Zealand	0.27	0.01
Japan	0.26	0.01
United Kingdom	0.25	0.01
Australia	**0.19**	**0.01**
United States	0.19	0.02
Canada	0.17	0.01
Ireland	0.15	0.02
Estonia	-0.22	0.01
Finland	-0.41	0.01

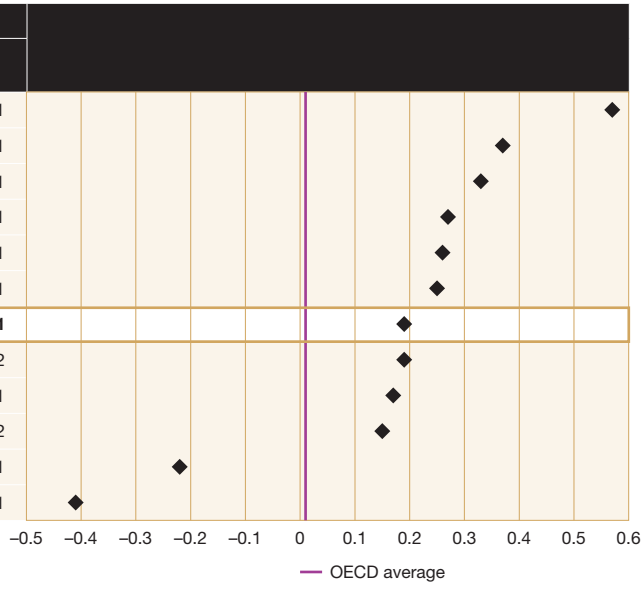


FIGURE A.1 Mean score on the schoolwork-related anxiety index, Australia and comparison countries

Among the high-performing comparison countries, Japan, Hong Kong (China), Macao (China), Singapore, and Canada all had mean scores on the schoolwork-related anxiety index that were significantly higher than the OECD average[1] (ranging from 0.17 in Canada to 0.57 in Singapore). Students in Finland and Estonia, however, had schoolwork-related anxiety scores that were significantly lower than the OECD average.

Australian students reported higher levels of schoolwork-related anxiety, on average, than across OECD countries, but lower than students in six of the comparison countries.

The average scores of students in the culturally similar English-speaking countries were all higher than the OECD average (0.15 in Ireland, 0.19 in the United States, 0.25 in the United Kingdom and 0.27 in New Zealand). Students in Australia had a mean score of 0.19 on the schoolwork-related anxiety index, which was significantly higher than the OECD average of 0.01, but lower than in six of the comparison countries.

Over the whole PISA assessment, 20 OECD countries recorded higher levels of schoolwork-related anxiety than Australia, while 33 OECD countries recorded lower levels of schoolwork-related anxiety than Australia.

Figure A.2 presents the relationship between schoolwork-related anxiety (grouped into quartiles) and scientific literacy performance. For Australian students, there was a small but negative relationship between schoolwork-related anxiety and scientific literacy performance (r= - 0.12). Students in the lowest quartile of the index of schoolwork-related anxiety scored 34 points higher in scientific literacy, on average, than those in the highest quartile.

This score point difference reflects the equivalent of around one year of schooling. Across the OECD, students in the lowest quartile of schoolwork-related anxiety scored 38 points higher in scientific literacy, on average, than those in the highest quartile.

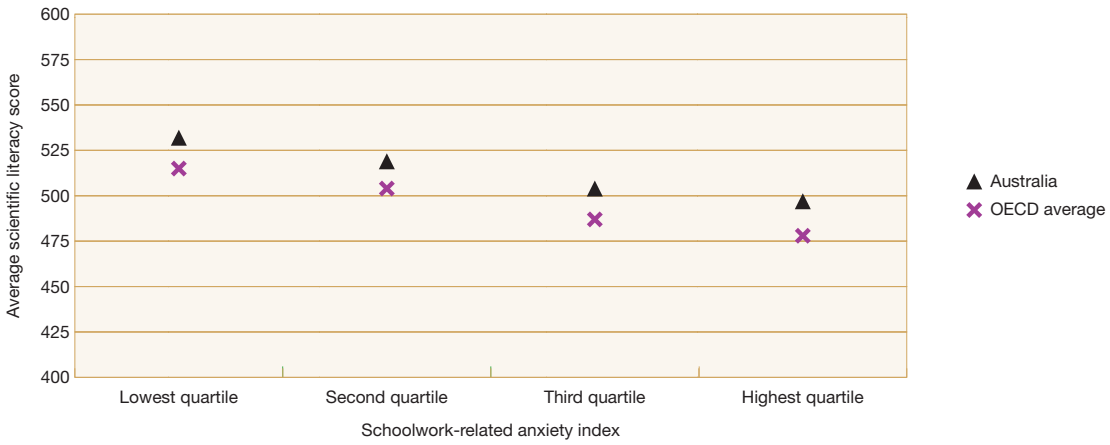


FIGURE A.2 Relationship between schoolwork-related anxiety and scientific literacy performance for Australia and the OECD average

1 In this chapter, the OECD average refers to OECD average-35 – those countries who participated in PISA 2015.

Internationally, students who were less anxious performed better in the assessment of scientific literacy than students who reported higher schoolwork-related anxiety.

For Australian students, a similar small negative relationship was found between schoolwork-related anxiety and mathematical literacy performance (r=-0.12), but a negligible negative relationship (r=-0.06) with reading literacy performance. Those with lower schoolwork-related anxiety scores tended to perform better in the scientific and mathematical literacy assessments, however the relationship was not as strong between schoolwork-related anxiety scores and performance on the reading literacy assessment.

While the results indicate a negative relationship between schoolwork-related anxiety and performance in the PISA scientific and mathematical literacy tests, the chronology is not clear. Which comes first, the 'chicken' of performance or the 'egg' of anxiety? Are students who report higher levels of anxiety less likely to perform well in a test environment? Or are students who know their subject matter less likely to report high anxiety?

Figure A.3 presents the proportions of Australian students who agreed with each of the schoolwork-related anxiety items compared to the proportion of students across OECD countries.

Significantly higher proportions of Australian students compared to students on average across the OECD agreed with all of the schoolwork-related anxiety items, except for *I worry that I will get poor grades at school*. The largest difference of 13 percentage points was in agreement to *even if I am well-prepared for a test, I feel anxious*.

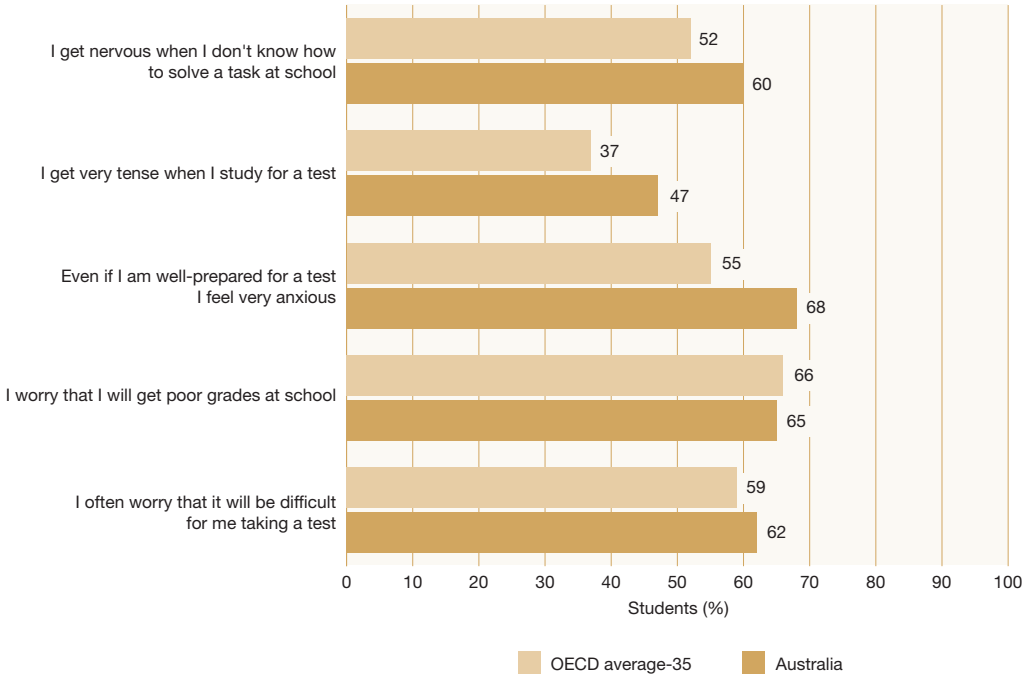


FIGURE A.3 Student agreement with schoolwork-related anxiety items, Australia and the OECD average

Table A.1 presents the percentage of students in each of the comparison countries who agreed with each of the schoolwork-related anxiety items, along with results for Australia and the OECD average for comparison.

Even among this selection of countries, students' attitudes towards their schoolwork and their experiences of anxiety varied greatly. Finland consistently recorded the lowest percentage of students who agreed with each of the schoolwork-related anxiety items, followed by Estonia. Only 18 per cent of Finnish students indicated that they get tense while studying for tests. In contrast, 60 per cent of students in Singapore agreed with this item. Eighty-six per cent of students in Singapore worry about getting poor grades at school and 78 per cent of students in Japan worry about having difficulty when taking a test. These differences lead us to questions about the experiences of students across countries – why are Finnish students so relaxed about their schoolwork in comparison to students in Japan and Singapore, and even the United States and Australia?

TABLE A.1 Student agreement with schoolwork-related anxiety items, Australian and comparison countries

	I often worry that it will be difficult for me taking a test		I worry that I will get poor grades at school		Even if I am well-prepared for a test I feel very anxious		I get very tense when I study for a test		I get nervous when I don't know how to solve a task at school	
Country	%	SE	%	SE	%	SE	%	SE	%	SE
Finland	*38*	0.8	*44*	0.9	*49*	0.8	*18*	0.5	*37*	0.7
Japan	**78**	0.6	82	0.6	62	0.8	33	0.6	50	0.7
Macao (China)	74	0.6	78	0.6	66	0.8	58	0.8	58	0.8
Estonia	51	0.8	55	0.8	53	0.8	28	0.7	41	0.8
Hong Kong (China)	71	0.7	82	0.6	67	0.7	53	0.7	58	0.7
New Zealand	65	0.8	67	0.9	72	0.7	51	0.7	61	0.9
Canada	59	0.5	64	0.5	64	0.4	46	0.5	63	0.4
Singapore	74	0.6	**86**	0.5	**76**	0.6	**60**	0.7	**71**	0.7
United Kingdom	62	0.7	67	0.7	72	0.7	52	0.7	55	0.7
United States	63	0.7	61	0.8	68	0.7	43	0.7	65	0.7
Australia	62	0.5	65	0.4	68	0.5	47	0.6	60	0.5
OECD average-35	59	0.1	66	0.1	55	0.1	37	0.1	52	0.1

Note: Highest index scores are presented in **bold**, lowest scores in *italics*

The previous PISA short report on motivation (Underwood, 2018) reported that Finland and Estonia also scored significantly lower than the OECD average on an index measuring students' achievement motivation (e.g. *a desire to be the best student in the class, I want to be the best, whatever I do*). This suggests an interesting pattern for these two countries – high performance associated with lower anxiety and attitudes that focus less on comparison and competition between students.

PISA results in other countries also suggest a relationship between schoolwork-related anxiety and achievement motivation – countries where students score highly on the achievement motivation index also tend to be the countries where many students feel anxious about a test, even if they are well-prepared for it – one of the items on the schoolwork-related anxiety index (OECD 2017). For Australian students, there was a small positive association between schoolwork-related anxiety and achievement motivation (r =0.10) – indicating that as achievement motivation increased, so too did anxiety about schoolwork.

Schoolwork-related anxiety across the Australian jurisdictions

Table A.2 presents students' schoolwork-related anxiety scores by jurisdiction, along with pairwise comparisons of the means of any two jurisdictions.

Students from the Australian Capital Territory reported schoolwork-related anxiety levels that were significantly higher than students from Western Australia, Victoria and Tasmania, but not significantly different to scores for students from Queensland, New South Wales, South Australia and Northern Territory.

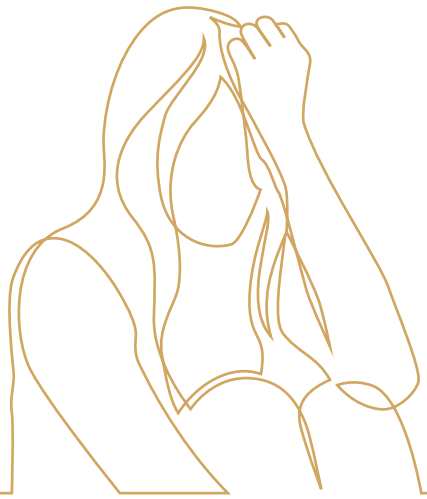
Students from Tasmania reported levels on the schoolwork-related anxiety index that were significantly lower than students from Australian Capital Territory, Queensland, New South Wales and South Australia but not significantly different to students from Western Australia, Northern Territory or Victoria.

TABLE A.2 Multiple comparisons of mean scores on the schoolwork-related anxiety index, by jurisdiction

Jurisdiction	Mean score	SE	ACT	QLD	NSW	SA	WA	NT	VIC	TAS	OECD average
ACT	0.28	0.04		●	●	●	▲	●	▲	▲	▲
QLD	0.24	0.02	●		●	●	▲	●	▲	▲	▲
NSW	0.23	0.02	●	●		●	●	●	▲	▲	▲
SA	0.20	0.02	●	●	●		●	●	▲	▲	▲
WA	0.17	0.02	▼	▼	●	●		●	●	●	▲
NT	0.16	0.06	●	●	●	●	●		●	●	▲
VIC	0.12	0.03	▼	▼	▼	▼	●	●		●	▲
TAS	0.11	0.04	▼	▼	▼	▼	●	●	●		▲
OECD average-35	**0.01**	**0.00**	▼	▼	▼	▼	▼	▼	▼	▼	

Note: read across the row to compare a jurisdiction's performance with the performance of each jurisdiction listed in the column heading.

▲ Average performance statistically significantly higher than in comparison jurisdiction
● No statistically significant difference from comparison jurisdiction
▼ Average performance statistically significantly lower than in comparison jurisdiction



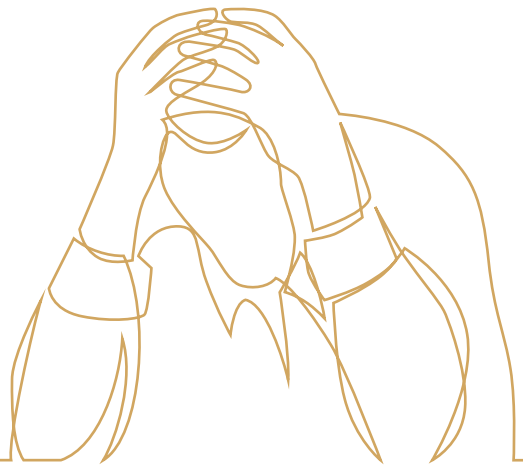
The average schoolwork-related anxiety scores for all jurisdictions were significantly higher than those of students across OECD countries on average.

Table A.3 shows the percentage of students in the Australian jurisdictions who agreed with each of the statements about schoolwork-related anxiety. The OECD average has been included for comparison. Australian students agreed more strongly with *even if I am well-prepared for a test, I feel very anxious*, while agreement with *I get tense when I study for a test* was relatively lower.

Overall, as would be expected, there were very few significant differences in student agreement with the schoolwork-related anxiety items across the jurisdictions. Students in Victoria, South Australia and Tasmania worried less about getting poor grades in school than students across the OECD, on average, while the responses of students in other jurisdictions were similar to the OECD average.

TABLE A.3 Student agreement with schoolwork-related anxiety items, by jurisdiction

	I often worry that it will be difficult for me taking a test		I worry that I will get poor grades at school		Even if I am well-prepared for a test I feel very anxious		I get very tense when I study for a test		I get nervous when I don't know how to solve a task at school	
Jurisdiction	%	SE	%	SE	%	SE	%	SE	%	SE
ACT	63	1.4	63	1.4	68	1.8	50	1.9	65	1.9
NSW	63	1.2	66	0.8	68	0.9	48	1.1	61	1.0
VIC	56	0.9	62	1.2	65	1.2	45	1.1	60	1.3
QLD	65	1.7	69	1.1	71	1.1	47	1.3	59	1.1
SA	64	1.0	61	1.4	67	1.2	48	1.2	60	1.4
WA	63	1.7	67	1.5	67	1.4	45	1.4	59	1.3
TAS	57	4.5	60	2.0	64	1.9	44	1.8	56	2.2
NT	64	8.1	61	3.0	65	2.9	51	3.2	60	2.8
OECD average	**59**	**0.1**	**66**	**0.1**	**55**	**0.1**	**37**	**0.1**	**52**	**0.1**



Schoolwork-related anxiety for different demographic groups in Australia

Figure A.4 presents the mean schoolwork-related anxiety scores for the different demographic groups of Australian students (information on the definition of the demographic groups is presented in Appendix A). The percentage agreement to each of the schoolwork-related anxiety items is presented in Table A.4.

Sex

Female students reported significantly higher levels of schoolwork-related anxiety than male students. This difference was recorded in all participating countries and economies in PISA 2015 (OECD, 2017). In addition, the anxiety levels for female students were significantly higher than the OECD average for all students, while those of male students were significantly lower than the OECD average.

> In Australia, as in all countries who participated in PISA 2015, female students reported higher anxiety related to their schoolwork than did their male peers.

Female students reported higher endorsement of all schoolwork-related anxiety items than did their male peers:

- *I get nervous when I don't know how to solve a task at school: 20 percentage points. This was the largest difference observed.*
- *I get very tense when I study for a test: 19 percentage points.*
- *I often worry that it will be difficult for me taking a test: 17 percentage points.*
- *I worry that I will get poor grades at school: 17 percentage points.*
- *Even if I am well-prepared for a test I feel very anxious: 17 percentage points.*

Differences as large and as consistent as these underline the importance of addressing issues of self-confidence in female students, particularly when there is a need for more women going into higher mathematics and STEM subjects at tertiary level. Students with low levels of self-confidence in relation to these areas are less likely to enter into these courses than students with higher levels of self-confidence.

Indigenous background

Indigenous students reported significantly higher levels of schoolwork-related anxiety than non-Indigenous students. Average scores for both groups were significantly higher than the OECD average.

While comparison of the average index scores indicated higher levels of schoolwork-related anxiety among Indigenous students than among non-Indigenous students, there were few significant differences in agreement with the individual items. Agreement with the item *I often worry that it will be difficult for me taking a test* was slightly higher among Indigenous students than among non-Indigenous students (5 percentage points).

Geographic location

There were no significant differences in the average schoolwork-related anxiety scores of students in metropolitan, provincial or remote schools, but all were significantly higher than the OECD average.

There were no significant differences in the percentages of students who agreed with each of the schoolwork-related anxiety items across the school location groups – agreement with the items was similar regardless of where students were located.

Socioeconomic background

Students from the lowest socioeconomic quartile reported significantly higher levels of schoolwork-related anxiety than students in the other three socioeconomic quartiles. All were significantly higher than the OECD average.

Compared to students in the highest socioeconomic quartile, higher proportions of students in the lowest quartile agreed that *I often worry that it will be difficult for me taking a test* (8 percentage points higher), that *I worry that I will get poor grades at school* (7 percentage points higher) and that *I get very tense when I study for a test* (6 percentage points higher).

Immigrant background

First-generation and foreign-born students reported significantly higher levels of schoolwork-related anxiety than Australian-born students. There was no significant difference, however, in the average anxiety scores of first-generation and foreign-born students. Again, all were significantly higher than the OECD average.

When comparing students' responses based on their immigrant background, higher proportions of students born overseas agreed that *I often worry that it will be difficult for me taking a test*, that *even if I am well-prepared for a test I feel very anxious* and that *I get very tense when I study for a test*.

	Mean index	SE
Sex		
Females	0.45	0.02
Males	-0.07	0.02
Indigenous background		
Indigenous	0.28	0.02
Non-Indigenous	0.19	0.01
Geographic location		
Metropolitan	0.20	0.01
Provincial	0.17	0.02
Remote	0.24	0.03
Socioeconomic background		
Lowest quartile	0.26	0.02
Second quartile	0.19	0.02
Third quartile	0.18	0.02
Highest quartile	0.14	0.02
Immigrant background		
Australian-born	0.16	0.02
First-generation	0.22	0.02
Foreign-born	0.25	0.03

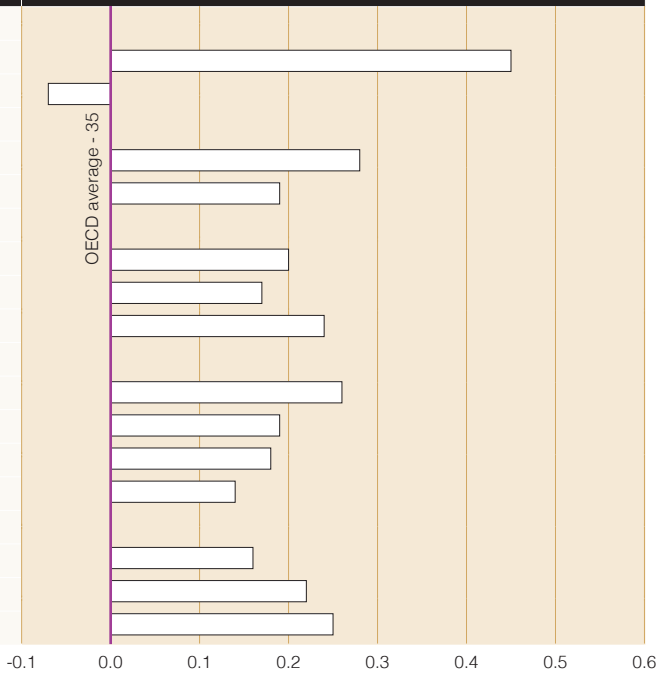
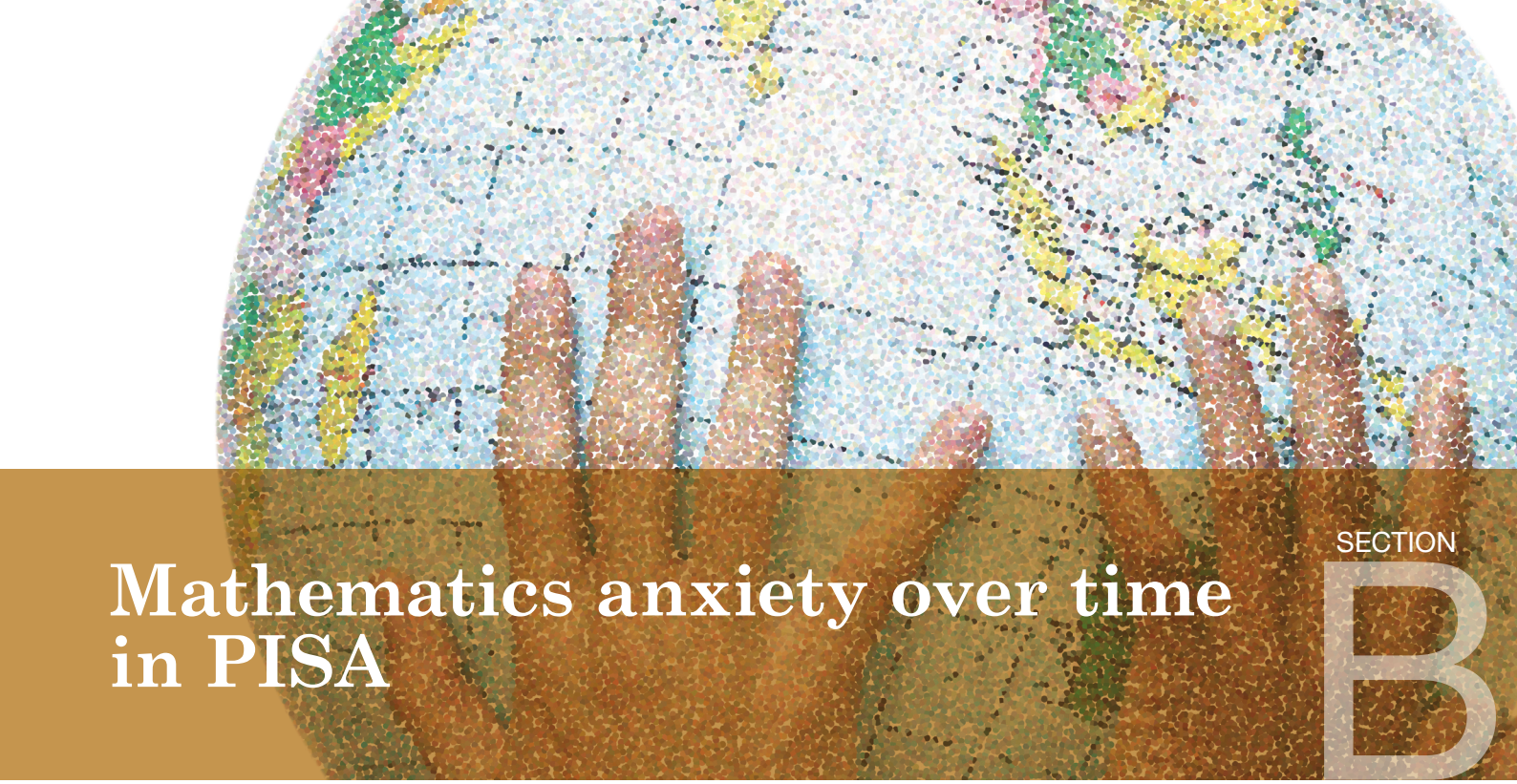


FIGURE A.4 Mean scores on the schoolwork-related anxiety index by sex, Indigenous background, geographic location, socioeconomic background and immigrant background

TABLE A.4 Student agreement with schoolwork-related anxiety items by demographic group

Demographic group	I often worry that it will be difficult for me taking a test		I worry that I will get poor grades at school		Even if I am well-prepared for a test I feel very anxious		I get very tense when I study for a test		I get nervous when I don't know how to solve a task at school	
	%	SE	%	SE	%	SE	%	SE	%	SE
Sex										
Females (F)	70	0.7	74	0.6	76	0.8	56	0.8	70	0.7
Males (M)	53	0.7	57	0.7	59	0.8	37	0.8	50	0.8
Difference F-M	**17**	**1.0**	**17**	**1.0**	**17**	**1.1**	**19**	**1.2**	**20**	**1.0**
Indigenous background										
Indigenous (I)	66	1.2	70	1.1	69	1.1	51	1.4	63	1.3
Non-Indigenous (N)	62	0.9	65	0.5	67	0.6	47	0.6	60	0.6
Difference I -N	**5**	**1.3**	**5**	**1.2**	1	1.3	**4**	**1.5**	**4**	**1.4**
Geographic location										
Metropolitan (M)	62	0.6	66	0.5	68	0.7	47	0.7	60	0.6
Provincial (P)	62	1.1	64	0.9	66	0.9	46	1.0	59	1.1
Remote (R)	65	2.3	66	3.3	68	2.1	52	5.4	63	2.7
Difference M -R	-3	2.3	-1	3.3	0	2.3	-4	5.6	-3	2.7
Difference M -P	0	1.3	2	1.0	2	1.1	2	1.2	1	1.3
Difference P-R	-3	2.5	-2	3.5	-2	2.3	-6	5.5	-4	2.9
Socioeconomic background										
Lowest quartile (L)	66	0.9	69	0.9	69	1.0	50	1.1	62	1.1
Second quartile	63	1.1	67	1.1	66	0.9	48	1.2	59	1.0
Third quartile	61	1.1	64	0.9	68	0.9	46	0.9	61	1.0
Highest quartile (H)	58	0.9	61	1.0	67	1.0	44	1.0	58	1.0
Difference L -H	**8**	**1.3**	**7**	**1.5**	2	1.3	**6**	**1.3**	**4**	**1.6**
Immigrant background										
Australian-born (AB)	60	0.7	64	0.7	66	0.7	46	0.7	59	0.7
First-generation (FG)	63	0.8	66	0.7	69	0.9	48	1.0	61	0.8
Foreign-born (FB)	66	1.4	69	1.5	71	1.1	51	1.6	62	1.5
Difference AB-FG	**-2**	**1.1**	**-3**	**1.1**	**-3**	**1.1**	-2	1.3	-2	1.0
Difference AB-FB	**-5**	**1.5**	**-5**	**1.7**	**-5**	**1.3**	**-5**	**1.7**	**-3**	**1.6**
Difference FG-FB	**-3**	**1.5**	**-2**	**1.1**	**-2**	**1.1**	**-3**	**1.3**	-1	1.0
OECD average -35	59	0.1	66	0.1	55	0.1	37	0.1	52	0.1

Note: Statistically significant differences between the groups are indicated in bold



SECTION B

Mathematics anxiety over time in PISA

Along with concerns about general aspects of schooling and schoolwork, students can also struggle with anxiety about particular subjects. Mathematics anxiety, defined as feelings of discomfort and apprehension when tackling a mathematics problem or task (Buckley et al, 2016), is one such area that is almost so prevalent as to be considered the norm. Declaring oneself a maths enthusiast is to gain a lot of extra elbow room at the table.

Students who have highly anxious responses to mathematics are likely to avoid career pathways that will involve interaction with mathematics (Buckley et al, 2016). Reluctance to interact with mathematics in and outside of school not only limits further education and career choices (as more universities award 'bonus' points for studying advanced mathematics and more jobs involve STEM) but can also place people at a disadvantage in the wider world, as financial literacy is closely related to mathematical literacy. Higher levels of mathematics anxiety among females leads to avoidance of the subject once it is not compulsory. This is reflected in enrolments in higher levels of mathematics at senior secondary school level which are declining faster for females than males (Mack & Walsh, 2013).

Mathematics anxiety was measured in two cycles of PISA 2003 and 2012, when mathematics was the major domain of assessment (refer to Appendix A for further information about the major domain of assessment for each PISA cycle).

In PISA 2003 and 2012, five mathematics anxiety items were included in the student questionnaires.

- *I often worry that it will be difficult for me in mathematics classes*
- *I get very tense when I have to do mathematics homework*
- *I get very nervous doing mathematics problems*
- *I feel helpless when doing a mathematics problem*
- *I worry that I will get poor grades in mathematics*

Students were asked to rate their agreement with each item (strongly agree; agree; disagree; or strongly disagree) and responses of 'agree' and 'strongly agree' were combined as agreement. While responses to these items were used to construct indices in both PISA cycles, the statistical scaling and construction techniques differed greatly, resulting in these indices not being comparable across cycles. The following discussion of changes in mathematics anxiety between PISA 2003 and 2012 will instead focus on the individual items (listed above).

Figure B.1 shows the percentage of students who agreed with the mathematics anxiety items for Australia and the OECD average. Australian students tend to agree more to the 'worry' items: *I often worry that it will be difficult for me in mathematics classes* and *I worry that I will get poor grades in*

mathematics, compared with the other items like *I feel helpless when doing a mathematics problem.* This was similar to students across the OECD, on average. Between PISA 2003 and PISA 2012, there was a small increase in agreement with all five items.

In 2003, 53 per cent of Australian students agreed that *I often worry that it will be difficult for me in mathematics classes*, and by 2012 this increased to 60 per cent. This difference of seven percentage points for Australia was larger than the increase reported on average over the OECD countries (a difference of 2 percentage points).

In 2003, 20 per cent of Australian students agreed that *I feel helpless when doing a mathematics problem* and by 2012 this increased to 25 per cent. The change was greater among Australian students than that reported on average over the OECD countries on average (5 percentage points compared to 1 percentage point).

Agreement with the item *I get very tense when I have to do mathematics* showed the biggest increase over the nine years. The proportion of Australian students agreeing (28%) was well below the OECD average (36%) in 2003 but a nine percentage point increase in the proportion of Australian students agreeing pushed the proportion to about the same as the OECD average (37% of Australians compared to 39% over the OECD).

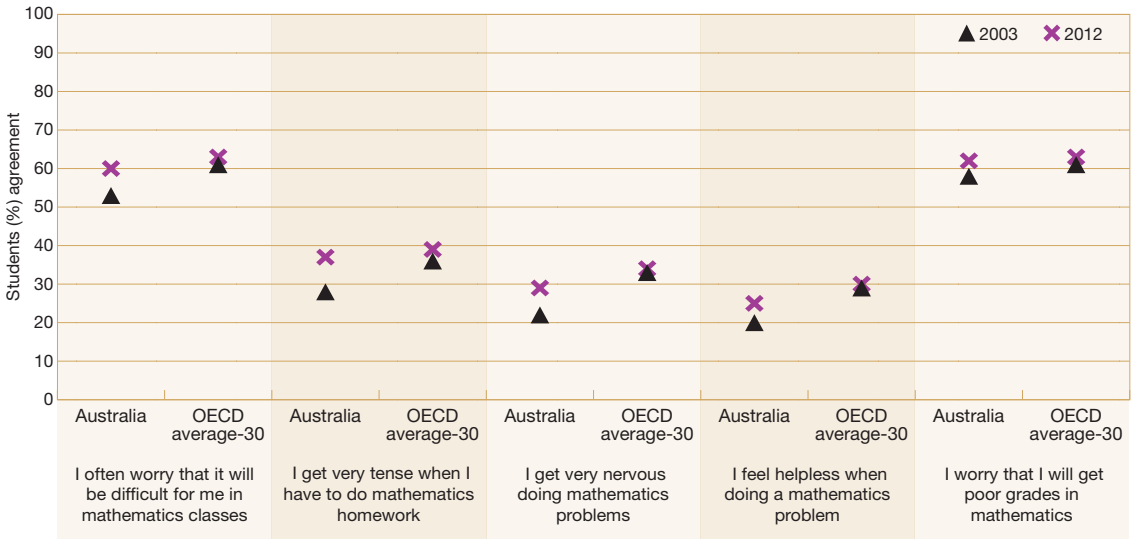


FIGURE B.1 Student agreement with mathematics anxiety items in PISA 2003 and 2012, for Australia and the OECD average

Table B.1 presents the changes between 2003 and 2012 in the proportions of students who agreed with the five mathematics anxiety items for the comparison countries.

Most of these countries have recorded an increase in agreement with the mathematics anxiety items over the nine years, with the greatest increases in Australia, Canada, Ireland and New Zealand.

The most pronounced increase for an item was in New Zealand. Between 2003 and 2012 the proportion of students who agreed that *they get very tense when they have to do mathematics homework* increased by 14 percentage points (24% to 38%). In Australia, the increase was 9 percentage points (28% to 37%).

The most pronounced decrease for an item was in Japan, where the proportion of students who agreed that *they get very nervous doing mathematics problems* decreased by 19 percentage points between 2003 and 2012 (58% to 39%), followed by Hong Kong (China) with a decrease of seven percentage points (33% to 26%). Among Australian students, agreement to this item increased by 7 percentage points (22% to 29%) between 2003 and 2012.

The proportion of students who agreed with *I get very tense when I have to do mathematics homework* increased dramatically in New Zealand, while the proportion of students who agreed with *I get very nervous doing mathematics problems* decreased in Japan.

TABLE B.1 Changes in agreement with mathematics anxiety items between 2003 and 2012 (PISA 2003 – PISA 2012)[2]

	I often worry that it will be difficult for me in mathematics classes.						I get very tense when I have to do mathematics homework.						I get very nervous doing mathematics problems.						I feel helpless when doing a mathematics problem.						I worry that I will get poor grades in mathematics.					
	2003		2012		Difference (2012-2003)		2003		2012		Difference (2012-2003)		2003		2012		Difference (2012-2003)		2003		2012		Difference (2012-2003)		2003		2012		Difference (2012-2003)	
Country	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Australia	52.8	0.7	59.7	0.6	6.9	0.9	27.7	0.6	36.8	0.6	9.1	0.8	21.9	0.6	28.9	0.6	6.9	0.8	20.0	0.5	24.6	0.5	4.6	0.7	58.1	0.6	61.8	0.7	3.7	0.9
OECD average-30	60.6	0.3	62.6	0.3	2.0	0.4	36.0	0.3	38.6	0.4	2.6	0.5	33.1	0.3	34.0	0.3	0.9	0.4	28.9	0.3	30.4	0.3	1.5	0.4	60.5	0.3	63.1	0.3	2.5	0.4
Canada	53.8	0.6	59.6	0.8	5.8	1	32.4	0.5	38.0	0.7	5.6	0.9	26.3	0.4	30.9	0.6	4.6	0.8	23.6	0.4	26.0	0.6	2.3	0.8	58.2	0.6	61.2	0.7	3.0	0.9
Finland	50.4	0.8	51.7	0.9	2.0	1.2	6.7	0.4	10.0	0.5	3.2	0.6	15.0	0.6	18.4	0.6	3.4	0.9	25.5	0.8	27.3	1.0	1.0	1.2	51.2	0.9	52.4	0.9	1.2	1.3
Hong Kong (China)	68.0	1.0	68.9	1.2	1.0	1.6	29.0	0.7	26.8	0.9	-2.2	1.1	33.3	0.9	26.4	1.0	-6.9	1.3	34.6	0.7	32.2	1.1	-3.0	1.4	71.9	0.9	70.8	0.9	-1.2	1.2
Ireland	59.8	0.9	69.8	0.9	10.0	1.3	30.3	0.8	36.0	1.0	5.7	1.3	26.2	0.7	29.7	0.9	3.5	1.1	26.3	0.8	28.0	0.9	1.7	1.2	60.2	0.9	62.1	1.0	1.8	1.4
Japan	68.7	0.8	70.4	0.8	1.0	1.1	51.5	1.0	55.5	0.9	4.0	1.3	57.9	1.0	39.5	0.9	-19.0	1.3	35.0	0.9	34.8	0.9	-0.2	1.2	66.0	0.7	67.0	0.8	1.0	1.1
New Zealand	52.1	1.0	62.1	1.1	10.0	1.4	24.4	0.8	38.1	1.0	13.8	1.3	21.2	0.7	33.0	1.0	11.8	1.2	21.3	0.7	26.6	1.0	6.0	1.2	56.2	0.9	63.6	0.9	8.0	1.2
United Kingdom	46.6	0.9	47.3	0.9	0.0	1.3	27.7	0.7	28.2	0.8	0.0	1.1	24.6	0.7	26.1	1.0	1.5	1.2	21.7	0.6	19.8	0.7	-1.9	0.9	57.8	0.9	57.6	0.9	-0.2	1.3
United States	56.1	0.9	57.3	1.0	1.3	1.4	33.9	0.7	36.6	1.1	2.7	1.3	26.4	0.8	29.0	0.9	2.6	1.3	22.8	0.6	22.5	0.9	-1.0	1.1	47.1	0.7	48.7	0.9	1.6	1.2

2 Estonia, Macao (China) and Singapore have not been included in this table as data on mathematics anxiety were not available for both cycles.

Changes in mathematics anxiety for different demographic groups in Australia

Sex

Figure B.2 presents the percentage of female and male students who agreed with each of the statements about mathematics anxiety in PISA 2003 and 2012.

During this time there have been significant increases in agreement with the mathematics anxiety items for both male and female students. These increases were largest on the items *I often worry it will be difficult for me in mathematics class* and *I get tense when I have to do mathematics homework*. On both of these items, agreement among female students rose 8 percentage points, while among males the increase was slightly smaller, at 5 percentage points.

In both cycles, female students recorded higher agreement with all five mathematics anxiety items than male students. There is also an indication that the differences between female and male students may be increasing over time, at least in their agreement with the items *I often worry that it will be difficult for me in mathematics classes* and *I get very tense when I have to do mathematics homework*. On both of these items, the difference in percentage agreement between females and males increased from 12 percentage points in 2003 (females 59% agreement and males 47% agreement) to 15 percentage points in 2012 (females 67% agreement and males 52% agreement).

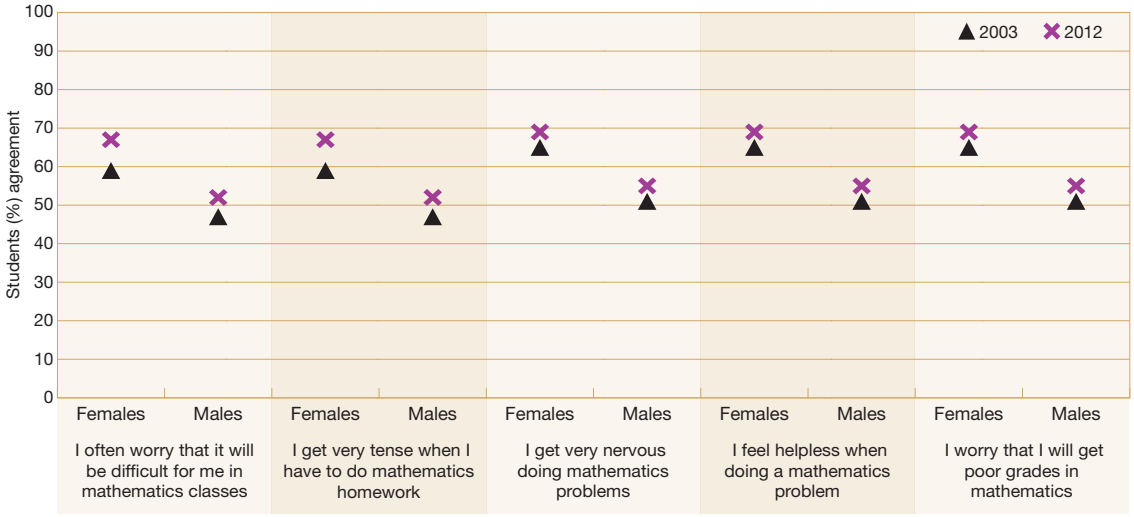


FIGURE B.2 Student agreement with mathematics anxiety items in PISA 2003 and PISA 2012, by sex

Indigenous background

Figure B.3 shows the percentage of Indigenous and non-Indigenous students who agreed with each of the statements about mathematics anxiety in PISA 2003 and 2012.

Over the 9 year period, agreement with all five mathematics anxiety items increased significantly among non-Indigenous students. Among Indigenous students, changes in agreement reached statistical significance on only three of the items:

- *I get very nervous doing mathematics problems*, which increased by 10 percentage points
- *I feel helpless when doing a mathematics problem*, which increased by five percentage points
- *I worry that I will get poor grades in mathematics*, which increased by five percentage points.

Despite increases in agreement with some items among non-Indigenous students, mathematics anxiety levels remain higher among Indigenous students, on average, than among non-Indigenous students.

In 2003, Indigenous students' agreement with *I get very nervous doing mathematics problems* and *I feel helpless when doing mathematics problems* were significantly higher than that of non-Indigenous students, on average (by 9 and 10 percentage points, respectively). By 2012, the differences between Indigenous and non-Indigenous students were significant on all five items. Even where agreement had increased among non-Indigenous students, such as with *I get very tense when I have to do mathematics homework,* anxiety was still higher among Indigenous students.

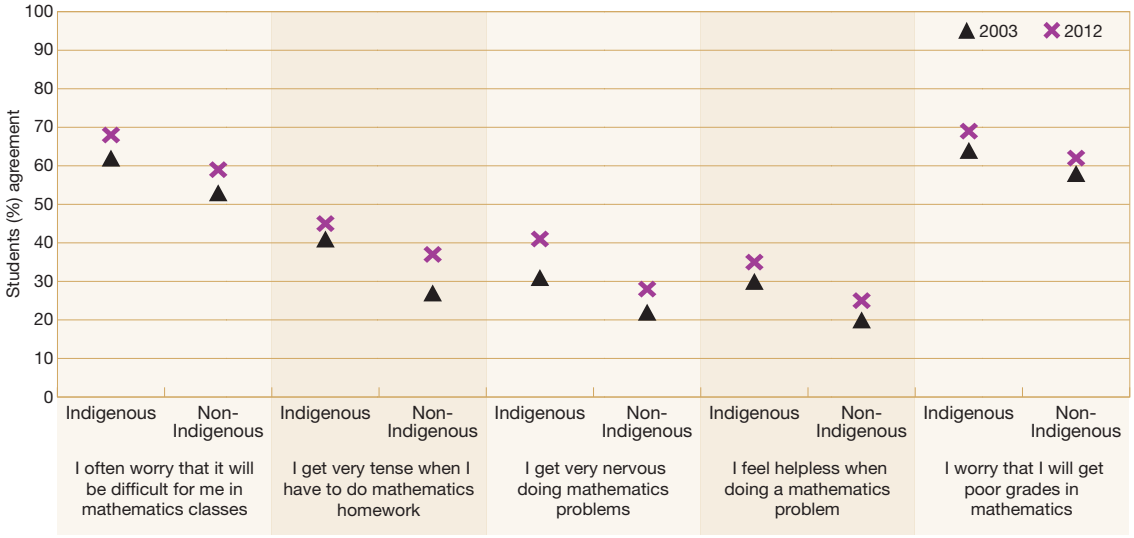


FIGURE B.3 Student agreement with mathematics anxiety items in PISA 2003 and PISA 2012, by Indigenous background

Geographic location

Figure B.4 shows the percentage agreement with each of the statements about mathematics anxiety in PISA 2003 and PISA 2012 across the three geographic locations of schools.

Students in metropolitan and provincial schools show increasing levels of mathematics anxiety over the time period, while for students in remote schools, the size of the sample and the resulting large standard errors associated with their results mean that many apparent 'changes' did not reach statistical significance.

The items with the largest increases in agreement (for students in metropolitan and provincial schools) were those to do with the more everyday issues of homework, solving mathematics problems and having difficulty in class, rather than broad concerns about getting poor grades.

In 2003, students from metropolitan and provincial schools recorded higher agreement with the item *I worry that I will get poor grades in mathematics* than students from remote schools. In 2012, however, there were no longer any group differences on this item.

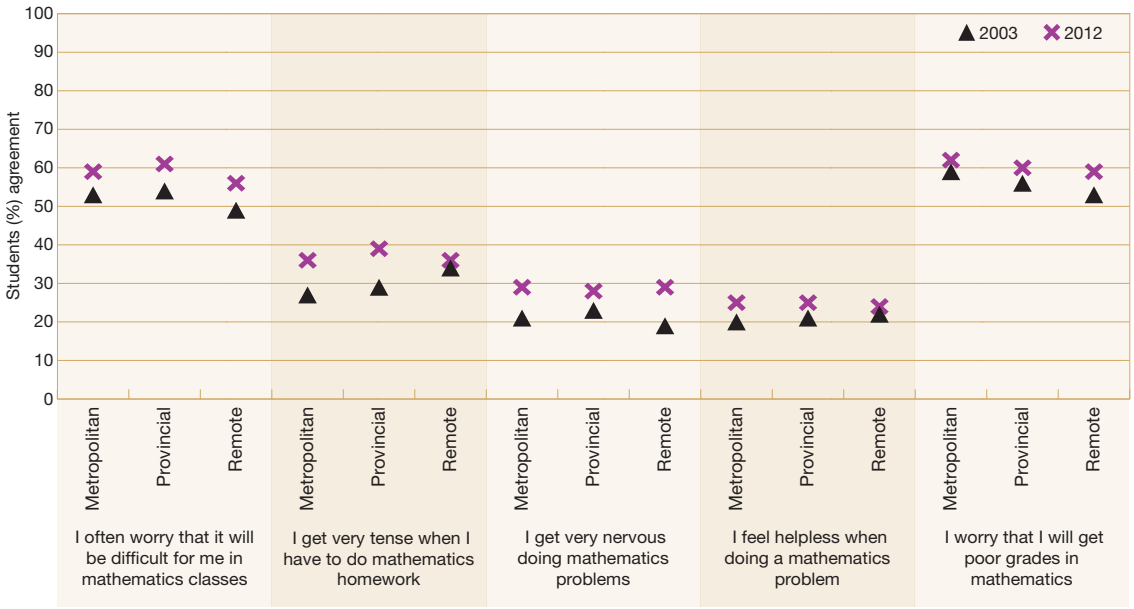


FIGURE B.4 Student agreement with mathematics anxiety items in PISA 2003 and PISA 2012, by geographic location

Socioeconomic background

Figure B.5 shows the percentage of students for each quartile of socioeconomic background who agreed with each of the statements about mathematics anxiety in PISA 2003 and 2012.

Agreement with the item *I worry that I will get poor grades in mathematics* did not change among students from the two highest quartiles of socioeconomic background, whereas agreement to this item increased significantly among less advantaged students between 2003 and 2012. On the other four mathematics anxiety items, agreement increased for all students. For example, agreement with the item *I get very tense when I have to do mathematics homework* increased by 11 percentage points among students in the lowest socioeconomic quartile, 10 percentage points for those in the middle two groups, and 7 percentage points for students in the highest quartile of socioeconomic background.

Students in the lowest quartile of socioeconomic background reported higher agreement with all five items of mathematics anxiety than students in the highest quartile in both PISA cycles. Despite across-the-board increases in mathematics anxiety, students from the lowest socioeconomic quartile still report higher levels of anxiety about mathematics than students from more advantaged backgrounds.

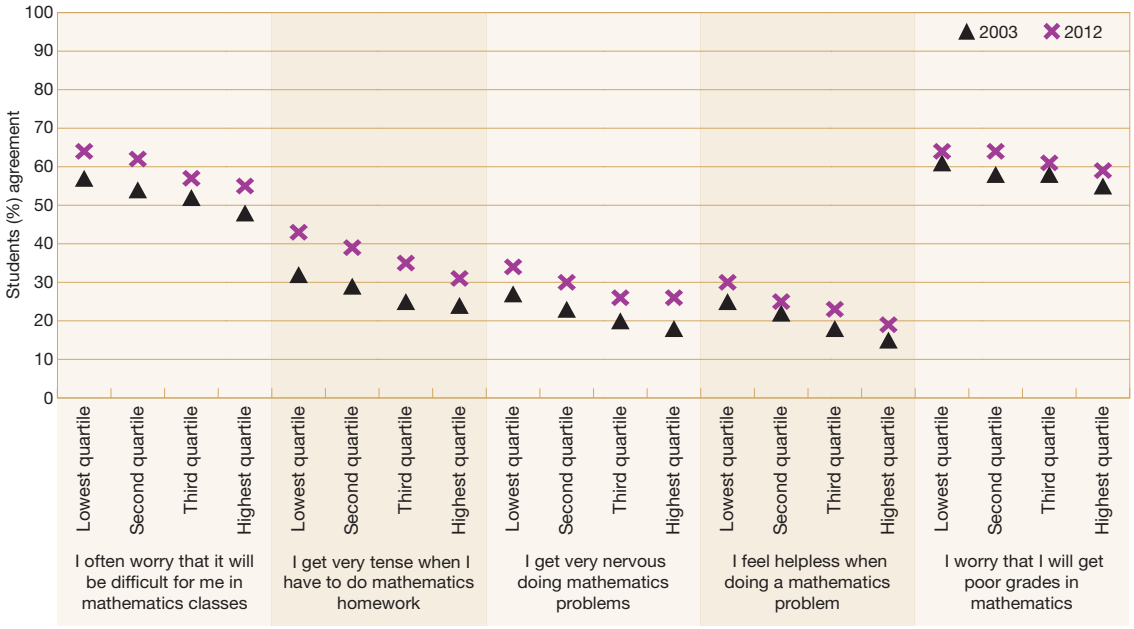


FIGURE B.5 Student agreement with mathematics anxiety items in PISA 2003 and PISA 2012, by socioeconomic background

Immigrant background

Figure B.6 presents the percentage of students agreeing with the mathematics anxiety items in PISA 2003 and 2012, by immigrant background.

Agreement with *I get very tense when I have to do mathematics homework* increased significantly among all three groups of students between 2003 and 2012 – by 8 percentage points among foreign-born students, 10 percentage points among Australian-born students and 11 percentage points among first-generation students.

For three items – *I often worry that it will be difficult for me in mathematics class, I get very nervous doing mathematics problems* and *I feel helpless when doing a mathematics problem* – agreement increased significantly among Australian-born and first-generation students, but remained at a similar level among foreign-born students.

Australian-born students were the only group to record a significant increase in agreement with the item *I worry that I will get poor grades in mathematics.* This change brought their level of agreement in line with that of the other two student groups in 2012.

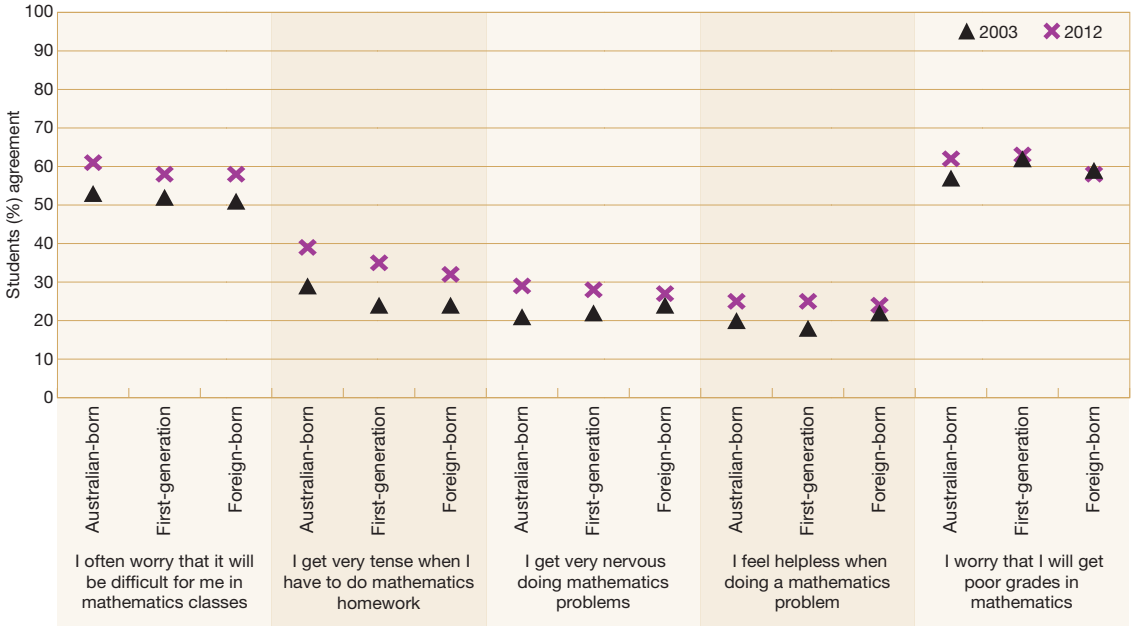


FIGURE B.6 Student agreement with mathematics anxiety items in PISA 2003 and PISA 2012, by immigrant background

In 2003, Australian-born students recorded significantly lower agreement with the item *I worry I will get poor grades in mathematics* than either foreign-born or first-generation students. Foreign-born students, in turn, recorded lower agreement with this item than first-generation students. In 2012, there were no longer any significant differences between these groups of students, which may be explained in part by the increase in agreement with this item among Australian-born students.

In 2003 and 2012, Australian-born students recorded significantly higher agreement to the item *I get very tense when I have to do mathematics homework* than foreign-born students and first-generation students. Despite increases in agreement across the three student groups, concern about doing mathematics homework remained higher among Australian-born students than other students.

Foreign-born students recorded higher agreement with *I feel helpless when doing a mathematics problem* than first-generation or Australian-born students in 2003, but in 2012 there were no longer any significant differences between the groups. This can be explained by the significant increase in agreement with this item among first-generation and Australian-born students between 2003 and 2012, while the percentage agreement among foreign-born students remained unchanged over this time.

Getting the balance right

This report has shown that, compared to many other students around the world, Australian students continue to report a relatively high level of anxiety when it comes to schoolwork-related tasks. In particular, worrying that things will be difficult seems to be more prevalent among many different groups of students. Gender differences continue to be an issue, with female students reporting higher levels of schoolwork-related anxiety than male students, and the gap increasing between females and males on a number of mathematics anxiety items. This is not an isolated issue: across participating PISA countries, there was not a single one in which male students reported higher levels of anxiety about schoolwork, or mathematics in particular, than their female peers. As female' participation in STEM continues to be a challenge for most countries, this is an area that should be addressed.

As seen in the previous PISA short report on motivation, while motivation to achieve provides students with the impetus to set goals for their future and to strive toward attaining these goals, it should be acknowledged that an *overemphasis* on this form of motivation can impact negatively on students' performance (Underwood, 2018). PISA results show that countries where students are highly motivated to achieve also tend to be the countries in which many students feel anxious about their schoolwork. Students who want to be able to select among the best opportunities when they graduate, who want to be the best in their class, or who want top grades in all courses are more likely to suffer from anxiety (OECD, 2017). This pattern also holds for Australian students.

The evidence presented in these two PISA short reports shows that there needs to be a balance found between striving for success (at least, in terms of beating one's peers) and placing pressure on oneself that is unnecessary and potentially harmful. Performance (however it is measured) is optimal where pressure is neither too low (i.e. where there are no stakes and no one really cares how anyone does) nor too high (i.e. where the stakes are too high, deadlines too tight and a sense of overwhelm and panic can set in).

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Appendix A: Reader's guide to PISA

What is PISA?

The Programme for International Student Assessment (PISA) is an international study that measures how well 15-year-olds, who are nearing the end of their compulsory schooling in most participating education systems, are prepared to use their knowledge and skills in particular areas to meet real-life opportunities and challenges. This is in contrast to assessments that seek to measure the extent to which students have mastered a specific curriculum. PISA's orientation reflects a change in the goals and objectives of curricula, which increasingly address how well students are able to apply what they learn at school.

PISA in Australia

PISA is a key part of the National Assessment Program (NAP). Components of NAP include the National Assessment Program – Literacy and Numeracy (NAPLAN), which is conducted annually for every student in Years 3, 5, 7 and 9; the national sample assessments of civics and citizenship, information and communication technology (ICT) literacy, and science literacy; and the international assessments, which comprise – in addition to PISA – the IEA's Trends in International Mathematics and Science Study (TIMSS) and Progress in International Reading Literacy Study (PIRLS).

Unlike NAPLAN, PISA is not a curriculum-based assessment and assesses a nationally representative sample of 15-year-olds (rather than a year-level based sample), providing national and group estimates rather than providing individual student results.

The results collected from these assessments allow for nationally comparable reporting of progress towards the *Melbourne Declaration on Educational Goals for Young Australians* (MCEETYA, 2008), which set goals for high-quality schooling in Australia designed to secure students the necessary knowledge, understanding, skills and values for a productive and rewarding life.

The Australian Curriculum, Assessment and Reporting Authority (ACARA) reports on these assessments annually in its *National Report on Schooling in Australia*, which is the main vehicle for reporting against nationally agreed key performance measures defined in the *Measurement Framework for Schooling in Australia 2015* (Australian Curriculum, Assessment and Reporting Authority, 2015).

The *Measurement Framework for Schooling in Australia 2015* outlines national standards for each of the elements of the NAP, including PISA. The national standard for PISA is a proficient standard, which represents a 'challenging but reasonable' expectation of student achievement. This National Proficient Standard for PISA has been set at Level 3 on the PISA proficiency scales for each domain.

What are the main goals of PISA?

PISA looks to answer several important questions related to education, such as:

- How well are young adults prepared to meet the challenges of the future? Can they analyse, reason and communicate their ideas effectively? Will their skills enable them to adapt to rapid societal change?
- Are some ways of organising schools and school learning more effective than others?
- What influence does the quality of school resources have on student outcomes?
- What educational structures and practices maximise the opportunities of students from disadvantaged backgrounds?
- How equitable is the provision of education within a country and across countries?

What does PISA assess?

The core assessment domains of scientific literacy, reading literacy and mathematical literacy are measured in PISA. The PISA 2015 cognitive assessment also included the additional domain of collaborative problem solving and financial literacy.

How often is PISA administered?

Since 2000, PISA has been conducted every three years. In each cycle, three core assessment domains are rotated so that one domain is the major focus (the major domain), with a larger amount of the assessment time being devoted to this domain compared to the other two assessment domains (the minor domains).

PISA 2015 was the sixth cycle of PISA and scientific literacy was the major domain, which allowed an in-depth analysis and the reporting of results by subscale to be undertaken. The assessment of scientific literacy as a major domain in PISA 2015 also allows for changes in performance to be reported over a nine-year period, from PISA 2006 when scientific literacy was first assessed as a major domain (Table A.1).

TABLE A.1 Summary of the core assessment domains in PISA

PISA 2000	PISA 2003	PISA 2006	PISA 2009	PISA 2012	PISA 2015
Reading literacy	Reading literacy	Reading literacy	Reading literacy	Reading literacy	Reading literacy
Mathematical literacy	Mathematical literacy	Mathematical literacy	Mathematical literacy	Mathematical literacy	Mathematical literacy
Scientific literacy	Scientific literacy	Scientific literacy	Scientific literacy	Scientific literacy	Scientific literacy

Major domain Minor domain

What did participants do?

Students

Students completed a two-hour cognitive assessment. Students were also allowed up to 45 minutes to complete the student questionnaires, which they responded to after the completion of the PISA cognitive assessment. Students then undertook the financial literacy assessment.

Students were randomly assigned to a test form that comprised four 30-minute clusters of cognitive materials, with each cluster consisting of units that required them to construct responses to a stimulus and a series of questions. The stimulus material was typically a short written passage or text accompanying a table, chart, graph, photograph or diagram. A range of item-response formats, such as multiple choice questions and questions requiring students to construct their own responses, was used to cover the full range of cognitive abilities and knowledge identified in the Assessment Framework.[1]

Students were assigned three student questionnaires. These consisted of the internationally standardised student questionnaire, and two additional student questionnaires that were offered as international options: an information and communications technology (ICT) questionnaire and an educational career questionnaire. The student questionnaire sought information on students and their family background, aspects of students' lives, such as their attitudes towards learning, their habits and life in and outside of school, aspects of students' interest, motivation and engagement, and learning and instruction in science, including instructional time and class size. The ICT questionnaire collected information on the availability and use of ICT, students' perceptions of their competence in completing tasks and their attitudes towards computer use. The educational career questionnaire gathered information about whether students had experienced interruptions of schooling and their preparation for their future career.

School principals

Principals from participating schools were asked to complete a school questionnaire, which collected descriptive information about the school, including the quality of the school's human and material resources, decision-making processes, instructional practices and school and classroom climate.

Administration of PISA

Students completed the cognitive assessment and questionnaires using computers with the delivery of the PISA assessment on USB drives. The school principals and teachers completed their questionnaires online using logins to a secure website. In Australia, PISA 2015 took place during a six-week period from late July to early September 2015. For most countries in the Northern Hemisphere, the testing period took place between March and May 2015. Together with appropriate application of the student age definition, this resulted in the students in Australia being at both a comparable age and a comparable stage in the school year to those in the Northern Hemisphere who had been tested earlier in 2015.

1 The Assessment Framework explains the guiding principles behind the PISA 2015 assessment. Refer to the *PISA 2015 assessment and analytical framework* (OECD, 2016).

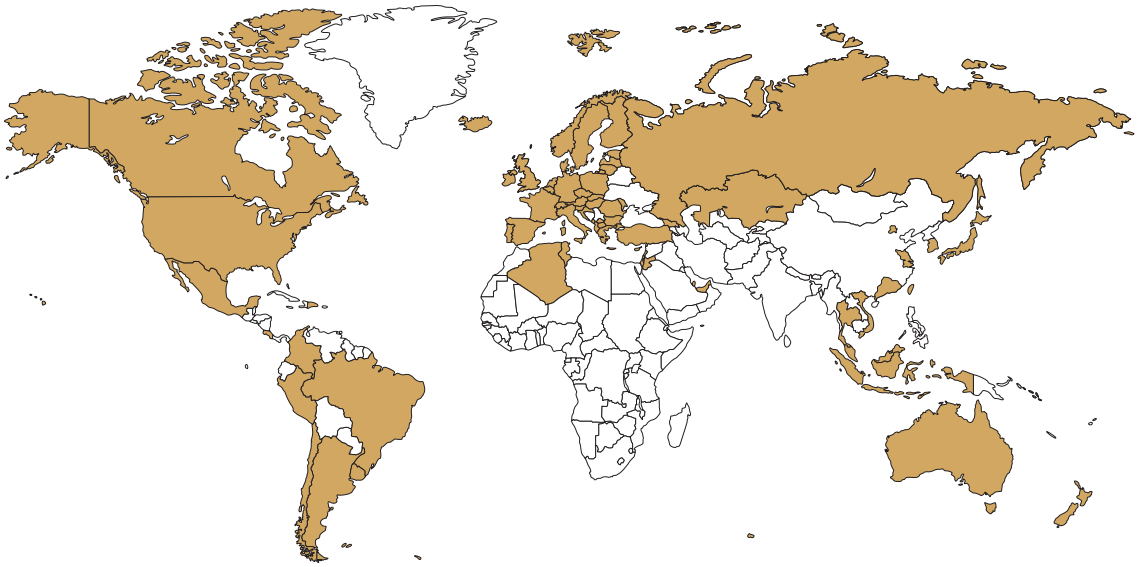
Who participates in PISA?

PISA aims to be as inclusive as possible of the population of 15-year-old students in each country and strict guidelines are enforced with regard to the percentage of schools and of students that could be excluded (which could not exceed 5% of the nationally desired target population).[2]

There are strict criteria on population coverage, response rates and sampling procedures. For initially selected schools, a minimum response rate of 85% (weighted and unweighted) was required, as well as a minimum rate of 80% (weighted and unweighted) of selected students. Countries that obtained an initial school response rate between 65% and 85% could still obtain an acceptable school response by the use of replacement schools. Schools with a student participation response rate lower than 50% were not regarded as participating schools. Australia successfully achieved the required response rates.

Countries

Although PISA was originally an OECD assessment created by the governments of OECD countries, it has become a major assessment in many regions and countries around the world. There were 72 countries and economies that participated in PISA 2015, including 35 OECD countries and 37 partner countries or economies (Figure A.1).[3]



OECD countries		
Australia	Hungary	Norway
Austria	Iceland	Poland
Belgium	Ireland	Portugal
Canada	Israel	Slovak Republic
Chile	Italy	Slovenia
Czech Republic	Japan	Spain
Denmark	Korea	Sweden
Estonia	Latvia	Switzerland
Finland	Luxembourg	Turkey
France	Mexico	United Kingdom
Germany	The Netherlands	United States
Greece	New Zealand	

Partner countries/economies		
Albania	Former Yugoslav	Moldova
Algeria	Republic of Macedonia	Montenegro
Argentina†	Georgia	Peru
Brazil	Hong Kong (China)	Qatar
B-S-J-G (China)*	Indonesia	Romania
Bulgaria	Jordan	Russian Federation
Chinese Taipei	Kazakhstan†	Singapore
Colombia	Kosovo	Thailand
Costa Rica	Lebanon	Trinidad and Tobago
Croatia	Lithuania	Tunisia
Cyprus	Macao (China)	United Arab Emirates
Dominican Republic	Malta	Uruguay
	Malaysia†	Vietnam

* B-S-J-G (China) refers to the four PISA participating provinces: Beijing, Shanghai, Jiangsu and Guangdong.

† Results for Argentina, Malaysia and Kazakhstan have not been reported in this report because their coverage was too small to ensure comparability.

Note: 15 countries (Albania, Algeria, Argentina, Georgia, Indonesia, Jordan, Kazakhstan, Kosovo, Lebanon, the Former Yugoslav Republic of Macedonia, Malta, Moldova, Romania, Trinidad and Tobago, and Vietnam) administered PISA as a paper-based assessment.

Although 72 countries and economies participated in PISA 2015, only those countries with an average score higher than the lowest scoring OECD country, Mexico, have been reported in this publication. Further details are provided in the Reader's Guide.

FIGURE A.1 Countries and economies which participated in PISA 2015

2 Refer to Appendix B in *PISA 2015: Reporting Australia's results* (Thomson, De Bortoli & Underwood, 2017).

3 PISA 2015 assessed the economic regions of Beijing, Shanghai, Jiangsu and Guangdong [B-S-J-G (China)], Chinese Taipei, Hong Kong (China) and Macao (China). Economic regions are required to meet the same PISA technical standards as other participating countries. Results for an economic region are only representative of the region assessed and are not representative of the country. For convenience, this report refers to these economic regions as countries.

Schools

In most countries, 150 schools and 42 students within each school were randomly selected to participate in PISA. In some countries, including Australia, a larger sample of schools and students participated. This allowed countries to carry out specific national options at the same time as the PISA assessment and for meaningful comparisons to be made between different sectors of the population.

In Australia, a larger sample of schools and students participated in PISA to produce reliable estimates that would be representative of each of the Australian jurisdictions[4] and of Indigenous students. In order for comparisons to be made between jurisdictions, it was necessary to oversample the smaller jurisdictions, because a random sample proportionate to jurisdiction populations would not yield sufficient students in the smaller jurisdictions to give a result that would be sufficiently precise. Further, a sufficiently large sample of Australia's Indigenous students was required so that valid and reliable separate analyses could be conducted.

The Australian PISA 2015 school sample consisted of 758 schools (Table A.2). The sample was designed so that schools were selected with a probability proportional to the enrolment of 15-year-olds in each school. Stratification of the sample ensured that the PISA sample was representative of the Australian population of 15-year-olds. Several variables were used in the stratification of the school sample including jurisdiction, school sector, geographic location, sex of students at the school and a socioeconomic background variable.[5]

TABLE A.2 Number of Australian PISA 2015 schools, by jurisdiction and school sector

	Sector			
Jurisdiction	Government	Catholic	Independent	Total
ACT	25	8	9	42
NSW	105	44	28	177
VIC	75	30	25	130
QLD	81	27	25	133
SA	55	22	21	98
WA	57	20	21	98
TAS	33	12	8	53
NT	15	5	7	27
Australia	**446**	**168**	**144**	**758**

Note: These numbers are based on unweighted data.

Of the Australian PISA schools, 87% were coeducational. Seven per cent of schools catered for all female students, while 6% catered for all-male students. Two per cent (15 schools) of the PISA 2015 schools were single-sex schools from the government school sector, 8% (58 schools) were from the Catholic school sector, and 3% (26 schools) were from the independent school sector.

Students

The target population for PISA is students who are aged between 15 years and 3 months and 16 years and 2 months at the beginning of the testing period and are enrolled in an educational institution, either full- or part-time. Since the largest part (but not all) of the PISA target population is made up of 15-year-olds, the target population is often referred to as 15-year-olds.

In each country, a random sample of 42 students was selected with equal probability from each of the randomly selected schools using a list of all 15-year-old students submitted by the school. Approximately 540 000 students took part in PISA 2015, representing about 29 million 15-year-old students internationally.

4 Throughout this report, the Australian states and territories are collectively referred to as jurisdictions.

5 Based on the Australian Bureau of Statistic's Socio-Economic Indexes for Areas.

Australia's PISA 2015 students

Across the jurisdictions

In most Australian jurisdictions, 20 students and all age-eligible Indigenous students were sampled per school. In the Australian Capital Territory, 30 students and all age-eligible Indigenous students were sampled per school, and in the Northern Territory, 27 students and all age-eligible Indigenous students were sampled per school. The Australian PISA 2015 sample of 14 530 students, whose results feature in the national and international reports, was drawn from all jurisdictions and school sectors according to the distributions shown in Table A.3.

TABLE A.3 Number of Australian PISA 2015 students, by jurisdiction and school sector

Sector		Jurisdiction								Total
		ACT	NSW	VIC	QLD	SA	WA	TAS	NT	
Government	N students	496	2053	1253	1905	922	1104	654	275	8662
	Weighted N	2304	46660	36144	31221	10273	16236	3710	1377	147925
Catholic	N students	210	849	530	579	391	355	248	115	3277
	Weighted N	1406	20634	14810	10784	4039	5635	1296	259	58863
Independent	N students	211	471	403	456	367	410	133	140	2591
	Weighted N	822	12906	13252	10903	3887	6356	944	472	49542
Australia	**N students**	**917**	**3373**	**2186**	**2940**	**1680**	**1869**	**1035**	**530**	**14530**
	Weighted N	**4532**	**80200**	**64206**	**52908**	**18199**	**28227**	**5950**	**2108**	**256330**

Note: N students is based on the achieved (unweighted) sample; weighted N is based on the number of students in the target population represented by the sample.

As the sample is age-based in PISA, the students come from various year levels but they are mostly from Years 9, 10 and 11. There are some variations to the year-level composition of the sample in the different jurisdictions as shown in Table A.4, because of differing school starting ages in different jurisdictions.

TABLE A.4 Percentage of Australian PISA 2015 students, by jurisdiction and year level

Jurisdiction	Year level					
	7	8	9	10	11	12
ACT			12	81	7	
NSW	^	^	12	81	6	
VIC	^	^	23	75	1	^
QLD		^	2	51	47	^
SA		^	8	87	5	^
WA			1	86	13	
TAS			32	68	^	
NT	^	^	8	79	13	
Australia	**^**	**^**	**11**	**75**	**14**	**^**

^ denotes percentages ≤ 1

Note: These percentages are based on unweighted data; the jurisdiction totals are reported as whole numbers without rounding off decimal places.

Table A.5 shows the number of Australian female and male students who participated in PISA by jurisdiction. There were equal proportions of females and males in four jurisdictions (the Australian Capital Territory, New South Wales, Victoria and Western Australia), while the proportion of males was higher than the proportion of females in: Queensland: 49% female; 51% male; South Australia: 49% female; 51% male; Tasmania: 48% female; 52% male; and Northern Territory: 49% female; 51% male.

TABLE A.5 Percentage of Australian PISA 2015 students, by jurisdiction and sex

Sex		Jurisdiction								Total
		ACT	NSW	VIC	QLD	SA	WA	TAS	NT	
Females	N students	441	1686	1102	1430	798	928	513	265	7163
	Weighted N	2254	40118	32163	25851	8828	14061	2835	1041	127151
Males	N students	476	1687	1084	1510	882	941	522	265	7367
	Weighted N	2278	40081	32043	27057	9370	14165	3116	1067	129177

Geographic location of schools

The locations of schools in PISA were classified using the MCEETYA Schools Geographic Location Classification (Jones, 2004). For the analysis in this report, only the broadest categories are used:

- metropolitan – including mainland capital cities or major urban districts with a population of 100 000 or more (e.g. Queanbeyan, Cairns, Geelong, Hobart)
- provincial – including provincial cities and other non-remote provincial areas (e.g. Darwin, Ballarat, Bundaberg, Geraldton, Tamworth)
- remote – including areas with very restricted or very little accessibility to goods, services and opportunities for social interaction (e.g. Coolabah, Mallacoota, Capella, Mount Isa, Port Lincoln, Port Hedland, Swansea, Alice Springs, Bourke, Thursday Island, Yalata, Condingup, Nhulunbuy).

Table A.6 shows about 75% of PISA 2015 participants attended schools in metropolitan areas, 25% were from provincial areas and the remaining 1% of participants attended schools in remote areas.

TABLE A.6 Number and percentage of Australian PISA 2015 students, by geographic location

Geographic location	N students	Weighted N	Weighted (%)
Metropolitan	9947	188606	74
Provincial	4065	64073	25
Remote	518	3650	1

Note: N students is based on the achieved (unweighted) sample; weighted N is based on the number of students in the target population represented by the sample.

Indigenous background

Indigenous background is derived from information provided by the school, which was taken from school records. Students were identified as being of Australian Aboriginal or Torres Strait Islander descent. For the purposes of this report, data for the two groups are presented together under the term 'Indigenous students'.

Every student from a participating school who identified as Indigenous was sampled for Australia's PISA. Four per cent of the PISA sample was of Indigenous background. Table A.7 shows the number of Australian Indigenous and non-Indigenous students who participated in PISA.

TABLE A.7 Number and percentage of Australian PISA 2015 students, by Indigenous background

Indigenous background	N Students	Weighted N	Weighted (%)
Indigenous	2807	10659	4
Non-Indigenous	11723	245670	96

Note: N students is based on the achieved (unweighted) sample; weighted N is based on the number of students in the target population represented by the sample.

Socioeconomic background

Information about students' socioeconomic background was collected in the student questionnaire. Students were asked several questions about their family and home background. This information was used to construct a measure of socioeconomic background: the economic, social and cultural status index (ESCS). The ESCS is based on three indices: the highest occupational status of parents (HISEI); the highest educational level of parents in years of education (PARED); and home possessions (HOMEPOS). The index of home possessions (HOMEPOS) comprises all items on the indices of family wealth (WEALTH), cultural resources (CULTPOSS), access to home educational and cultural resources and books in the home (HEDRES). It must be noted that there have been some adjustments to the computation of ESCS over the PISA cycles.

Using this index, participating students were distributed into quartiles of socioeconomic background. The distribution of Australian students by school sector is provided in Table A.8, and shows there were higher proportions of students from lower socioeconomic backgrounds who attended government schools (34%) compared to the proportions of students who attended Catholic schools (16%) or independent schools (10%). Conversely, there were lower proportions of students from higher socioeconomic backgrounds who attended government schools (17%) compared to the proportions of students who attended Catholic schools (29%) or independent schools (44%).

TABLE A.8 Number and percentage of Australian PISA 2015 students, by socioeconomic background quartiles and school sector

Socioconomic background	Government			Catholic		
	N students	Weighted N	Weighted (%)	N students	Weighted N	Weighted (%)
Lowest quartile	3122	48261	34	577	9043	16
Second quartile	2212	38663	27	833	14671	25
Third quartile	1696	31483	22	927	17366	30
Highest quartile	1192	23596	17	888	16927	29

Socioconomic background	Independent			Total weighted % of PISA population
	N students	Weighted N	Weighted (%)	
Lowest quartile	283	4828	10	25
Second quartile	486	8812	18	25
Third quartile	728	13366	28	25
Highest quartile	1045	21585	44	25

Note: N students is based on the achieved (unweighted) sample; weighted N is based on the number of students in the target population represented by the sample.

Immigrant status

The student questionnaire collected information about the country of birth of students and their parents. For the analysis in this report, immigrant background is defined by the following categories:

- Australian-born students – students born in Australia with both parents born in Australia
- first-generation students – students born in Australia with at least one parent born overseas
- foreign-born students – students born overseas with both parents also born overseas.

Table A.9 shows that just over 50% of students to sit PISA 2015 were Australian-born, 30% were first-generation and 12% of students were foreign-born.

TABLE A.9 Number and percentage of Australian PISA 2015 students, by immigrant background

Immigrant background	N students	Weighted N	Weighted (%)
Australian-born	8483	137006	53
First-generation	3795	76985	30
Foreign-born	1465	31468	12

Note: N students is based on the achieved (unweighted) sample; weighted N is based on the number of students in the target population represented by the sample. The weighted % doesn't sum to 100% as 4% of students didn't provide these details.

Target population for PISA

This report uses '15-year-olds' as shorthand for the PISA target population. In practice, the target population was students aged between 15 years and 3 (complete) months and 16 years and 2 (complete) months at the beginning of the assessment period, and who were enrolled and attending an educational institution full-time or part-time. Since the majority of the PISA target population is made up of 15-year-olds, the target population is often referred to as 15-year-olds.

Rounding of figures

Because of rounding, some numbers in tables may not exactly add to the totals reported. Totals, differences and averages are always calculated on the basis of exact numbers and are rounded only after calculation. When standard errors have been rounded to one or two decimal places and the value 0.0 or 0.00 is shown, this does not imply that the standard error is zero, but that it is smaller than 0.05 or 0.005 respectively.

Confidence intervals and standard errors

In this and other reports, student achievement is often described by an average score. For PISA, each average score is calculated from the sample of students who undertook PISA 2015 and is referred to as the sample average. The sample average is an approximation of the actual average score (known as the population average) that would have been obtained had all students in a country actually sat the assessment. Since the sample average is just one point along the range of student achievement scores, more information is needed to gauge whether the sample average is an underestimation or overestimation of the population average. The calculation of confidence intervals can indicate the precision of a sample average as a population average. Confidence intervals provide a range of scores within which we are confident that the population average actually lies.

In this report, each sample average is presented with an associated standard error. The confidence interval, which can be calculated using the standard error, indicates that there is a 95% chance that the actual population average lies within plus or minus 1.96 standard errors of the sample average.

Statistical significance

The term 'significantly' is used throughout the report to describe a difference that meets the requirements of statistical significance at the 0.05 level, indicating that the difference is real, and would be found in at least 95 analyses out of 100 if the comparisons were to be repeated. It is not to be confused with the term 'substantial', which is qualitative and based on judgement rather than statistical comparisons. A difference may appear substantial but not statistically significant (due to factors that affect the size of the standard errors around the estimate, for example) while another difference may seem small but reach statistical significance because the estimate was more accurate.

OECD average

An OECD average was calculated for most indicators in this report and is presented for comparative purposes. The OECD average corresponds to the arithmetic average of the respective country estimates, and can be used to compare a country on a given indicator with a typical OECD country.

- OECD average-35: refers to the average across all the 35 OECD countries in PISA 2015.
- OECD average-30: refers to the average across all the 30 OECD countries in PISA 2003, with the exception of Chile, Estonia, Israel, Slovenia and the United States.

PISA indices

The measures that are presented as indices summarise student responses to a series of related items constructed on the basis of previous research. In describing students in terms of each characteristic (e.g. self-efficacy in science, enjoyment of learning science), scales were originally constructed on which the OECD average was given an index value of 0,[6] and about two-thirds of the OECD population were given values between –1 and +1 (the index has a mean of 0 and a standard deviation of 1). Negative values on an index do not necessarily imply that students responded negatively to the underlying items. Rather, a student with a negative score responded less positively than students on average across OECD countries.

The indices are based on all categories for each item, whereas the reported percentages are collapsed into fewer categories. Due to this and the weighting of responses, a ranking based on the value of the indices will sometimes not exactly correspond to one based, say, on the average of the percentages.

Sample surveys

PISA is a sample survey and is designed and conducted so that the sample provides reliable estimates about the population of 15-year-old students. The PISA 2015 sample was a two-stage stratified sample. The first stage involved the sampling of schools in which 15-year-old students could be enrolled. The second stage of the selection process randomly sampled students within the sampled schools. The following variables were used in the stratification of the school sample: jurisdiction; school sector; geographic location; sex of students at the school; and a socioeconomic background variable (based on the Australian Bureau of Statistics' Socio-economic Indexes for Areas, which consists of four indexes that rank geographic areas across Australia in terms of their relative socioeconomic advantage and disadvantage).

Further information

PISA is an international comparative study which assesses a sample of 15-year-old students in reading, mathematical and scientific literacy. Further information about PISA in Australia, including the full national PISA 2015 report, is available from the national PISA website: www.acer.org/ozpisa/

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6 However, in instances where a scale has been used in a previous PISA cycle, the OECD average in PISA 2015 may not be equal to 0. This may be due to the increase in the number of OECD countries and/or changes in the responses to the items over time